

Claims

What is claimed is:

1. A solid state electrochemical device, comprising:

5 at least one unit, said unit comprising a first electrochemical cell and a second electrochemical cell, wherein:
each cell comprises a first electrode and a second electrode separated by a solid state electrolyte, and
wherein each cell is positioned adjacent to one another such that electrodes of one type
10 are facing inward toward one another and electrodes of the other type are each facing outward, and wherein
the inwardly spaced electrodes are positioned so as to define a space there between sufficient for passage of a gas during operation of the device.

2. The solid state electrochemical device as claimed in claim 1, wherein:

15 the first electrochemical cell and the second electrochemical cell each comprise a laminate comprising a first electrode which is a fuel electrode, an electrolyte and a second electrode which is an air electrode having a current collector attached thereto, wherein:
the fuel electrodes are facing inward and opposite each other.

20 3. The solid state electrochemical device as claimed in claim 2, wherein:

each electrochemical cell has a first end and a second end, and wherein
the first electrochemical cell and the second electrochemical cell are sealed to one another by a seal at the first end and a seal at the second end.

4. The solid state electrochemical device as claimed in claim 3, wherein:

the seal at the first end is electrically conductive and is connected to a housing that is electrically conductive, and the seal at the second end is electrically insulating and is connected to a housing that is electrically conductive, and
the current collector of at least one air electrode is attached to the housing.

5. The electrochemical device as claimed in claim 4, wherein:

the current collector is embedded in the air electrode.

6. The electrochemical device as claimed in claim 4, wherein:

the current collector is on top of the air electrode.

7. The electrochemical device as claimed in claim 4, wherein:

10 the current collector of the air electrode of the first cell is connected to the air electrode of the second cell, and the air electrode of the second cell is electrically connected to the housing.

8. An electrochemical device as claimed in claim 4, further comprising:

a plurality of units, each unit connected to at least one other adjacent unit, such that
15 during operation of the device current is able to flow from one unit to the adjacent unit.

9. An electrochemical device as claimed in claim 2, wherein:

both air electrodes form an outwardly facing side of the unit and are exposed to ambient air, and the unit has a first side edge and a second side edge, wherein:
the first side edge and second side edge are sealed by a manifold,

20 said manifolds defining an enclosed space between the first side edge manifold, the spaced apart fuel electrodes and the second side edge manifold, such that during operation fuel may be passed from one side edge manifold through the enclosed space between the fuel electrodes and through the other side edge manifold.

10. The electrochemical device as claimed in claim 9, further comprising:

a fuel manifold comprising a first inlet section and a second exhaust section separated from the first inlet section, and wherein the first side edge manifold is connected to the fuel manifold first inlet section and the second side edge manifold is connected to the fuel manifold second exhaust section.

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11. The electrochemical device as claimed in claim 10, further comprising:

an electrically insulating seal between the first and second side edge manifolds and the fuel manifold.

12. The electrochemical device as claimed in claim 11, further comprising:

10 separators disposed in the space between the fuel electrodes.

13. The electrochemical device as claimed in claim 10, further comprising:

a plurality of units attached to the fuel manifold, wherein:

the units are exposed to ambient atmosphere except where connected to the fuel manifold and the units are electrically connected in series so that current may flow from one unit to another unit.

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14. The electrochemical device as claimed in claim 2, wherein:

the fuel electrode and electrolyte of the first electrochemical cell are sealed at a first end, the fuel electrode and electrolyte of the second electrochemical cell are sealed at a first end end, and wherein:

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the seal for the first cell and second cell may be the same seal or different seals.

15. The electrochemical device as claimed in claim 14, wherein:

the first and second electrochemical cells are sealed at a first end with an electrically insulating seal, the first and second electrochemical cells are sealed at a second end with an electrically conductive seal, and further comprising:
air electrodes disposed outwardly of the electrolyte of the first electrochemical cell and
the second electrochemical cell.

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16. The electrochemical device of claim 15, further comprising:

a current collector attached to the air electrode of the first electrochemical cell, said current collector operatively attached to the air electrode of the second electrochemical cell.

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17. The electrochemical device as claimed in claim 15, further comprising:

a plurality of units, each of said plurality of units having an adjacent unit, and wherein the adjacent units are electrically connected by an interconnect wire that connects the current collector of the air electrode of the second electrochemical cell to the electrically conductive seal of the first electrochemical cell in an adjacent unit.

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18. The electrochemical device as claimed in claim 17, wherein:

the current collector is embedded in the air electrode.

19. The electrochemical device as claimed in claim 17, wherein:

the current collector is on top of the air electrode.

20. An electrochemical device as claimed in claim 15, wherein:

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both air electrodes form an outwardly facing side of the unit and are exposed to ambient air, and the unit has a first side edge and a second side edge, wherein:
the first side edge and second side edge are sealed by an manifold,

said manifolds defining an enclosed space between the first side edge manifold, the spaced apart fuel electrodes and the second side edge manifold, such that during operation fuel may be passed from one side edge manifold through the enclosed space between the fuel electrodes and through the other side edge manifold.

5 21. The electrochemical device as claimed in claim 15, further comprising:
 separators disposed in the space between the fuel electrodes.

22. The electrochemical device as claimed in claim 15, wherein:
 the device is a solid oxide fuel cell.

23. The electrochemical device as claimed in claim 15, wherein:
10 the device is an oxygen generator.

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